PART 1

1&2. Which of the following elemental names is **incorrectly** matched with its symbol?

(a) magnesium/Mg  (b) lead/Ld  
(d) tin/Sn  (e) mercury/Hg

(c) sodium/Na

3&4. The correct name for CH₃OH is:

(a) methane  
(b) ethanol  
(c) acetone  
(d) methanol  
(e) ethane

5&6. You can find 2 atoms of sulfur in

(a) 2 moles of NaOH  
(b) 1 mole of H₂SO₄  
(c) 1 molecule of H₂SO₄  
(d) 2 formula units of BaS  
(e) 2 grams of S
7&8. What is the percent of carbon by mass in Vitamin E, C\textsubscript{29}H\textsubscript{50}O\textsubscript{2}?

(a) 80.9%  
(b) 86.3%  
(c) 77.4%  
(d) 71.2%  
(e) 29.0%

9&10. How many millimoles of Vitamin E, C\textsubscript{29}H\textsubscript{50}O\textsubscript{2}, are present in 10.0 g of Vitamin E?

(a) 33.9 mmol  
(b) 20.7 mmol  
(c) 23.2 mmol  
(d) 43.6 mmol  
(e) 28.6 mmol

11&12. How many kilograms of sodium are there in 30.0 kilograms of Na\textsubscript{2}CrO\textsubscript{4}?

(a) 2.76 kg  
(b) 4.17 kg  
(c) 6.22 kg  
(d) 1.88 kg  
(e) 8.52 kg
13&14. An unknown organic compound composed of carbon, hydrogen and oxygen was analyzed and found to be 50.84% C, 8.53% H and 40.63% O by mass. Which of the following represents the correct empirical formula for the compound?

(a) CH₂O  
(b) C₃H₆O₂  
(c) C₄H₈O₃  
(d) C₂H₄O  
(e) C₅H₁₀O₃

15&16. What mass of K₂O can be prepared from the reaction of 10.0 g of K with excess KNO₃?

\[ \text{K} + \text{KNO}_3 \rightarrow \text{K}_2\text{O} + \text{N}_2 \]  
(unbalanced - you need to balance this first)

(a) 2.71 g  
(b) 14.5 g  
(c) 24.6 g  
(d) 33.7 g  
(e) 41.2 g
17&18. How many grams of $\text{K}_3\text{PO}_4$ are required to prepare 300.0 mL of solution that is 2.00% $\text{K}_3\text{PO}_4$? The density of the solution is 1.1 g/mL?

(a) 6.6 g  (b) 5.8 g  (c) 7.1 g  (d) 4.2 g  (e) 3.8 g

19&20. How many grams of $\text{K}_3\text{PO}_4$ are required to prepare 300.0 mL of a solution that is 0.200 M?

(a) 9.83 g  (b) 11.1 g  (c) 12.7 g  (d) 10.5 g  (e) 14.3 g
21&22. How many grams of Na₂O₂ can be produced from the reaction of 10.0 g of sodium metal with excess oxygen gas if the percent yield of the reaction is only 55%?

\[ 2 \text{Na} + \text{O}_2 \rightarrow \text{Na}_2\text{O}_2 \]

(a) 5.8 g     (b) 9.3 g     (c) 8.6 g     (d) 6.8 g     (e) 12.2 g

23&24. How many milliliters of 0.300 M HBr (hydrobromic acid) are required to react with 0.500 g of Ca(OH)₂ (FW = 74.1 g/mol) according to:

\[ 2 \text{HBr} + \text{Ca(OH)}_2 \rightarrow \text{CaBr}_2 + 2 \text{H}_2\text{O} \]

(a) 45.0 mL    (b) 21.3 mL    (c) 50.1 mL    (d) 14.0 mL    (e) 28.6 mL
PART 2

Please read and sign: “On my honor, as an Aggie, I have neither given nor received unauthorized aid on this exam.”

(10 pts) 25. Give the appropriate name or formula for a compound:

(a) copper(II) nitrate ________________________

(b) ammonium chloride _____________________

(c) calcium acetate _________________________

(d) Fe(NO₃)₃ _________________________________

(e) CaS ___________________________________

(5 pts) 26. Consider the following reaction: H₂O + Na → H₂ + NaOH UNBALANCED

Balance the equation and describe what is happening as the reaction proceeds using the terms: atom, formula unit, and molecule.
27. Water is formed by the direct reaction of hydrogen gas and oxygen gas, according to the reaction: 
\[ \text{H}_2(g) + \text{O}_2(g) \rightarrow \text{H}_2\text{O}(g) \] UNBALANCED

(2 pts) (a) Balance the equation.

(5 pts) (b) Suppose you start the reaction with 2.0 moles of \( \text{O}_2 \) and 5.0 moles of \( \text{H}_2 \). How many moles of \( \text{H}_2\text{O} \) can you make? What reactant is left over? How much of it is in excess?

(4 pts) (c) The initial system before the reaction began is represented by:

\[ \text{H}_2(g) \quad \text{O}_2(g) \quad \text{H}_2\text{O}(g) \]

Draw a picture of the system after the reaction has gone to completion.

(4 pts) (d) Briefly explain this reaction and your picture using the concept of limiting reactant.
28. A scientist has two containers of sulfur and knows that she has Avogadro's number of sulfur atoms in each one. One container has only S₄ molecules in it and the other has only S₈ molecules in it. Answer the following questions and show your work to get full credit.

(4 pts) (a) Are the number of molecules the same in each container? Explain.

(6 pts) (b) Calculate the number of moles of sulfur molecules in each sample. Are the numbers the same? Draw a picture to defend your results.